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AN ESSAY

TOWARDS A HISTORY OF THE PRINCIPAL COMETS THAT HAVE APPEARED SINCE THE YEAR 1742.

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THE following Eſſay is intended for the uſe of ſuch only as give mathematicians credit for their calculations of the orbits, or paths of Comets in the heavens; and who, (taking it for granted that thoſe calculations are juſt) wiſh to gratify their curioſity, as well with regard to the reſult of mathematical demonſtrations, as to the phænomena, and moſt intereſting particulars of theſe erratick ſtars.

An aſtronomer, armed at all points with *Theorems*, *Problems*, *Corollaries*, *Lemmas*, and *Scholia*, is a very formidable being, and equally inacceſſible to the generality of mankind, with the ſtars about which he writes. And yet, without theſe terrible arms to defend him from ignorance and preſumption, his ſcience would degenerate into judicial aſtrology, and he would be little better than a juggler or a fortune-teller. It is therefore intended in ſketching out the following little hiſtory of Comets, to ſave the reader the expence of purchaſing, and trouble of peruſing a great number of difficult and dry treatiſes, and to give him the ſum and ſubſtance of ſuch diſcoveries and concluſions, as have proceeded from the moſt laborious and operoſe calculations, to which human intelligence can reach. And it ſhould be remembered, that though the foregoing letter is written in a familiar and ſportive ſtile, and accommodated to the perception of the ladies, and ſuch as are unſkilled in mathematicks, yet it is founded on true ſcience: the author having been among the firſt, and moſt able geometricians, who adopted and explained the Newtonian philoſophy in France, and who, by his journey to the polar circle, in order to meaſure a degree, has proved and illuſtrated it, by aſcertaining the figure of the earth to be juſt what our great countryman had always ſuggeſted it to be.

THE

HISTORY

OF THE

PRINCIPAL COMETS

That have appeared ſince the Year 1742.

IN the preceding letter it has been remarked, that Dr. Halley upon the Newtonian theory, had determined the elements of twenty-four Comets*. At preſent the number of thoſe that have been accurately obſerved, and whoſe orbits are calculated, is more than doubled. A particular detail of ſuch as are moſt intereſting may therefore be acceptable to our readers. We ſhall however, only juſt mention the Comets of 1702, 1706, and 1718, whoſe elements different aſtronomers have determined by the Newtonian method; but ſhall be a little more particular about that of 1729. A Comet rendered very ſingular, if not by its brilliancy, at leaſt by other circumſtances. It was firſt perceived at Niſmes, by father Sarabel, a Jeſuit, July 31, between Canis Minor and the Dolphin, it was ſo ſmall and dull, that during moon light, it was ſcarce viſible; however, this father informed Caſſini, and the academicians of it, who obſerved it from the 1ſt of Auguſt till the 21ſt of January 1730, when it diſappeared. Their obſervations are publiſhed in the Memoirs of the Academy of Sciences for the year 1730, and after them Maraldi, in 1742, has calculated the parabolic trajectory, which it deſcribed. Many other aſtronomers have done the like, as the Abbé de la Caille, M. de Liſle, Mr. Kies, aſtronomer at Berlin, M. Struick, &c. It paſſed between the orbit of Mars and that of Jupiter, but much nearer the latter; hence it was always ſo ſmall and moved ſo ſlow, (for it hardly advanced an eighteenth of a degree in the ſix months it was obſerved) at firſt its motion was direct, and then retrograde, like the ſuperior planets. Calculation agreed ſo well with theſe obſervations, that though they amounted to fifty, the difference in longitude exceeds not three minutes, and in latitude only a few ſeconds.

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* The elements of a Comet are the five articles which determine the poſition and magnitude of the parabola it deſcribes, and which conſtitute its theory; namely, its node, inclination, place of its perihelion, perihelion diſtance, which is the ſquare of the parameter, and the time when the Comet arrives at its perihelion.

We ſhall paſs over the Comet of 1737 calculated in the Philoſophical Tranſactions, N° 446. That of 1739, of which ſeveral aſtronomers have given the elements; and come to that of

1742. This Comet, notwithſtanding M. de Maupertuis thinks it ſo contemptible, was obſerved by Mr. Betts at Oxford, who ſuppoſed its magnitude to be, at leaſt equal to that of the Earth.

1743. Two Comets appeared this year. The firſt was obſerved by M. Struick, the ſecond by Mr.

Klenkenberg; but both were ſmall and offered no remarkable phenomena to common obſervers.

1744. The Comet which appeared this year, was firſt ſeen in England, at the obſervatory of the Earl of Macclesfield, December 23, 1743. It ſeems to have been accurately obſerved at Oxford by the reverend Mr. Betts, who in his journal, January 23, 1744, ſays, " The Comet this evening appeared extremely bright and diſtinct, and " the diameter of its nucleus, nearly equal to that " of Jupiter, its tail extending above ſixteen degrees from its body." and adds, " That on February 23 the prodigious brightneſs it acquired, " by its near approach to the ſun, made it viſible " in the day time." The nodes of this Comet, and the planet Mercury, were ſituated within leſs than half a degree of each other; which gave riſe to a report that the Comet had carried Mercury from its orbit: but, ſays Mr. Betts, " Upon computing their heliocentric conjunction, which happend February 18, I found the Comet was, " at that time, diſtant from Mercury nearly one " third part of the great circle; being twice as near the Sun, as the planet Mercury. This was the moſt conſiderable Comet that had appeared ſince the year 1680.

M. des Chezeaux (Eſſais de Phyſique 1751) obſerves, that at its firſt appearance, it had no tail, at leaſt perceptible to the naked eye; but in approaching the Sun, it acquired one which increaſed every day till it arrived at its perihelion; ſo that February the 17th it was forty degrees long, and it ſtill augmented conſiderably after the perihelion; for though the body of the Comet could no longer be ſeen, the tail was viſible two hours before ſun-riſe, 20 or 30 degrees above the horizon, while the body was below it. According to this author, the tail was divided into five large ſtreams, or bands, and muſt have afforded a ſtrange ſpectacle, if the Earth had been at that time in a favourable poſition for obſerving it. This Comet, and that of 1742, gave riſe to ſeveral learned and ingenious works. Soon after M. de Maupertuis' letter, came out the Theory of Comets by M. le Monnier, 8vo. in which, beſides the tranſlation of Halley's Synopſis, is included an introduction and hiſtorical ſupplement concerning the progreſs of this theory, before and ſince Newton's time; together with divers intereſting particulars relative to the catalogue of the fixed ſtars, and theory of the Sun: the treatiſe of M. des Chezeaux, mentioned above: Oſſervazioni intorno la Cometa dell anno 1744, or obſervations concerning the Comet of 1744 by Zanotti, profeſſor at Bologna; and an excellent treatiſe by the celebrated Euler, called Theoria Motuum Planetarum, & Cometarum, or Theory of the motions of Planets and Comets, &c, &c.

1746. The Comet of this year was firſt obſerved at Lauſanne, Auguſt 13, by M. des Chezeaux; and was ſeen afterwards by many other aſtronomers. It was then proceeding to its perihelion, to which it arrived not before February 8, 1747.

1748. M. Struyck informs us, (Philoſophical Tranſactions) that in the month of May this year, three Comets were viſible, both at Amſterdam, and in other parts of Europe, on the very ſame night; of which there is no other inſtance in hiſtory: one of them was obſerved by F. Hallerſtein, at Pekin in China, from April 26, to June 18, who ſays (Philoſophical Tranſactions abridged, vol. x.) "The

" Comet ſeen by us this year was very diſmal, for
" beſides its ſhining with a very obſcure and ma-
" lignant light, it went in ſo deſert a path, and in
" ſuch an unfavourable ſky, that it could be ob-
" ſerved but very ſeldom, and be compared with
" but a few ſmall ſtars not well known."

1757. It is remarked by M. Montucla (Hiſtory of Mathematics) that near ten years had elapſed ſince any Comet had appeared. A very uncommon circumſtance, if we may judge by the frequency of theſe phenomena for ſome centuries paſt, ſince Comets have been ſo narrowly watched. The Comet of this year, however, came kindly to relieve our impatience. It was accurately obſerved by Dr. Bradley, from September 12, to October 11, and again on the 18th and 19th of the ſame month.
" When I firſt diſcovered this Comet (ſays the
" doctor, Philoſophical Tranſactions, vol. L.) it ap-
" peared to the naked eye like a dull ſtar of the
" fifth or ſixth magnitude; but viewing it through
" a ſeven foot teleſcope, I could perceive a ſmall
" nucleus, (ſurrounded, as uſual, with a nebulous
" atmoſphere) and a ſhort tail, extending in a di-
" rection oppoſite the Sun."

" It kept nearly at the ſame diſtance from the
" the Earth for about ten or twelve days together,
" after I firſt ſaw it; but its brightneſs gradually
" increaſed then, becauſe it was going nearer to
" the Sun. Afterwards, when its diſtance from the
" Earth increaſed, though it continued to approach
" the Sun, yet its luſtre never much exceeded that
" of ſtars of the ſecond magnitude; and the tail
" was ſcarce to be ſeen by the naked eye."

The elements the doctor has given of this Comet (adapted to Dr. Halley's general table for the motion of Comets in parabolic orbits) will be ſufficient to enable future aſtonomers to diſtinguiſh it upon another return; but as they do not correſpond with the elements of the orbit of any other Comet hitherto taken notice of, we cannot at preſent detertime its period.

This Comet was likewiſe obſerved by Mr. Klenkenberg at the Hague, who in a letter to Dr. Bradley ſays, "It appears very evident not only from "my calculation, but from every other circum-"ſtance of this Comet, that it is not the ſame with "that of the year 1682, which on certain accounts "is very deſirable to be known; for both here, "and in other parts of the Netherlands, there have "been ſome people who have publiſhed mere con-"jectures; and have ventured (very minutely and "exactly, as they pretended) about the time that "this Comet firſt appeared, to predict the return "of that of 1682: but by the above obſervations "the weakneſs of their pretenſions is evident; "whereas, if this had proved to be the expected "Comet, they would have aſſumed to themſelves "much undue praiſe, and have pretended to know-"ledge even ſuperior to the every-where much ce-"lebrated Newton, and Halley."

1758. Aſtronomers were much diſappointed this year in not finding Dr. Halley's prediction fulfilled: who in his Synopſis of Comets has theſe words, "and indeed there are many things which make "me believe that the Comet which Appian ob-"ſerved in the year 1531, was the ſame with that "which Kepler and Longomontanus took notice "of and deſcribed in the year 1607, and which I

“ myſelf have ſeen return and obſerved in 1682
“ All the elements agree, and nothing ſeems to
“ contradict this my opinion, beſides the inequality
“ of the periodic revolutions: which inequality is
“ not ſo great neither, as that it may not be owing
“ to phyſical cauſes. For the motion of Saturn is
“ ſo diſturbed by the reſt of the planets, eſpecially
“ by Jupiter, that the periodic time of that planet
“ is uncertain for ſome whole days together. How
“ much more therefore will a Comet be ſubject to
“ ſuch like errors, which riſes almoſt four times
“ higher than Saturn, and whoſe velocity, though
“ increaſed but very little, would be ſufficient to
“ change its orbit from an elliptical to a parabolic
“ one. However, I am further confirmed in my
“ opinion of the Comets which appeared at the
“ above periods, being the ſame; and let me alſo
“ add, that in the year 1456, in the ſummer time,
“ a Comet was ſeen paſſing retrograde between the
“ Earth and Sun, much after the ſame manner:
“ which, though nobody made obſervations upon
“ it, yet from its period, and the manner of its
“ tranſit, I cannot think different from thoſe I have
“ juſt mentioned. Hence I dare venture to foretel
“ that it will return again about the year
“ 1758.”

As this is a point, and a period, of equally great importance in aſtronomy, we muſt not paſs them over too haſtily. Mr. Barker in a letter to Dr. Bradley, 1755 (inſerted in the Philoſophical Tranſactions of that year) has given, in twelve ſhort tables, the apparent path of this Comet, ſuppoſing its perihelion any month in the year, with its accurate diſtance from the Earth. But as no allowance was made for the diſturbance this Comet might have met with, either from the planets, or other

Comets, in its path, it did not return within the period for which his tables were conſtructed.

But while all the world was big with expectation, and aſtronomers had turned night into day, in hopes of the accompliſhment of that prediction which was to confirm their favourite theory: while ſcoffers began to triumph in the hope that theſe ſtar-gazers were no greater conjurors than themſelves; and while the friends to ſcience began to tremble for the event: the profound and indefatigable M. Clairaut, one of the famous academicians who accompanied M. de Maupertuis in his voyage to the polar circle, remembering Dr. Halley had ſuggeſted that it was poſſible for the Comet of 1682 to be impeded or accelerated in its courſe, by its approximation to Jupiter, went to work in order to diſcover by calculation, its approaches, not only to Jupiter, but to the reſt of the planets, and to find out their attractive powers over it. What a ſtupendous undertaking! but let him ſpeak for himſelf. " The return of the Comet of 1682, in the time " preſcribed by the Newtonian theory, (advertiſe- " ment to his Theory of Comets, Par. 1760) is one " of thoſe events which diffuſe new light upon the " laws of nature, and which conſtitute a memorable " æra in ſcience. An event which has effectually " diſſipated the laſt remaining cloud which could " poſſibly obſcure the ſyſtem of attraction.

" In the year 1757, I had a mind to make a new " application of the ſolution I had given of a fa- " mous problem ten years before*, to demonſtrate

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* This was the problem of three bodies, firſt applied to the theory of the Moon. Vide Principia, lib. iii. prop. 25. prob. 6.

" the univerſality of gravitation. The ſubject
" which afforded me this new application, was the
" Comet of 1682, which was then expected to
" return according to Halley's prediction from
" Newton's theory. As the action of the great
" planets upon this Comet might produce one or
" many years variation in its period, it rendered its
" return ſo uncertain that it was equally expected
" in 1757 or 1759*: I propoſed therefore to find
" the true time when the expected Comet would
" reach its perihelion."

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* Though this has been aſſerted by Mr. Barker and many others, from the firſt edition of the Synopſis of Comets publiſhed in 1705; yet it is not exact. Dr. Halley then indeed foretels the return of this Comet in 1758. But many years afterwards, when he had carefully ſearched into the catalogues of ancient Comets, and diſcovered that three others in the ſame order, and at like intervals of time had preceded the three upon which his conjecture was founded, he began to be much more confirmed in his former opinion, of all theſe being one and the ſame Comet. But, after accounting for ſome ſmall diverſity in their inclinations and periods from the action of Jupiter, which, by its attraction, alters the proper velocity of the Comet when in its neighbourhood, the Doctor adds, " it is probable that its " return will not be till after the period of ſeventy-ſix years or " more, about the end of the year 1758, or the beginning of " the next. *Circa finem anni* 1758, *vel initium proximi futu-* " *rum.*" This puts the year 1757 quite out of the queſtion.

N. B. The above is taken from Dr. Halley's Tabulæ Aſtronomicæ, publiſhed in 1749, ſeven years after the author's death, and ten years before the accompliſhment of his prediction, which he finiſhes by theſe remarkable words. " You ſee there- " fore an agreement in all the elements of the three laſt ap- " pearances, (in 1531, 1607, and 1682) which would be next " to a miracle if they were three different Comets, or if it was " not the approach of the ſame Comet towards the Sun and " Earth, in three different revolutions round them. Wherefore, " if, according to what we have already ſaid, it ſhould return " again about the year 1758, candid poſterity will not re- " fuſe to acknowledge that this was firſt diſcovered by an " Engliſhman."

"The labour upon which I entered was im-"menſe, and I was unable to arrive at any certain "concluſion before the Autumn of 1758. I then "thought it behoved me not to loſe a moment, "ere I acquainted the public and aſtronomers, "with the reſult of my operations."

November 14, 1758, he preſented to the Royal Academy of Sciences a memorial upon the ſubject and ſucceſs of his enquiries. He there undertakes to prove, that the retardation of the expected Comet, ſo far from injuring, would confirm the ſyſtem of attraction, as it was a neceſſary conſequence of the extent of that power. "This is a "queſtion which has not hitherto been examined "by geometricians: if it had, the reſult muſt "always have been given conditionally. A body "which paſſes into ſuch remote regions, and re-"mains out of ſight during ſuch long intervals, "may be affected by cauſes wholly unknown to "us; ſuch as the action of other Comets, or "even by planets, too diſtant from the Sun ever to "be perceived by us."

After this author had calculated all the diſturbance that Jupiter might have occaſioned to the Comet during its three entire revolutions, a new difficulty occurred: he found it neceſſary to go through the ſame operations with regard to Saturn; the maſs of which planet being one third of that of Jupiter, might, *cæteris paribus*, produce one-third of its effect: and that was ſufficient to merit a particular examination.

As to the other heavenly bodies in our ſyſtem, their maſſes not amounting to the hundredth part of thoſe of the two ſuperior planets, their effect is almoſt inſenſible.—He found that the action of Jupiter upon the Comet, during the whole revolution of 1531 to 1607, had occaſioned a diminution of nineteen days in its period, which would not have happened by the mere force of the ſun; and at the ſame time had altered its elements ſo as to produce an acceleration of near thirty one days in the following period.

" Proceding afterwards to the Revolution from " 1607 to 1682. The action of Jupiter turns " out much more conſiderable; for it occaſions an " acceleration of about 420 days, which added to " the 31 reſulting from the action of the ſame " planet during the preceding period, amounts in " all to 451 days of diminution in the time of its " period; which would not have happen'd merely " by its inclination to the ſun.

" Now if we take the difference of theſe two ac- " celerations, in order to know how much ſhorter " the ſecond period was than the firſt, it appears " to be 432 days; which differs only 37 days from " the time reſulting from the obſervations.

" And this period appears to be ſtill diminiſhed " by the action of Saturn. Indeed this diminution " is not much, becauſe the effects of Saturn's " force are almoſt reciprocally deſtroyed in the " two firſt periods."

" Hence we ſee that the theory gives within a " month, the difference ſo remarkable between the " two known revolutions of this Comet. Now if " we conſider the length of theſe periods, the " complication of the two cauſes of their irregu- " larity, and the nature of the problem by which

" they are meaſured; this new demonſtration of
" the Newtonian ſyſtem will perhaps be found as
" ſtriking as any one that has hitherto been given."

" By comparing, in like manner, the force of
" the action of Jupiter, during the ſecond period
" of the Comet, with that which will be terminated at its approaching return; I find the revolution about which we are at preſent intereſted
" will be 518 days longer than the preceding, occaſioned by the action of Jupiter upon the Comet,
" from its laſt mean diſtance to its perihelion:
" that is, for the laſt ſeven or eight years; an interval, during which there can hardly be more
" than fifteen days alteration.

' As to Saturn, the reſult of its action on the
" Comet, is much more conſiderable compared
" with the two firſt revolutions; for I find the
" preſent period protracted more than 100 days
" by it, independent likewiſe of its action ſince
" 1751, and another ſmall object which I have
" not had time to determine. From theſe conſiderations, then, it appears to me that the expected Comet ought to arrive at its perihelion,
" about the middle of the month of April next
" enſuing."

This is a long quotation, but the ſubject of the memoir is curious, and the ſucceſs of M. Clairaut, in determining ſo nearly a point of ſuch importance to aſtronomy, and ſo intereſting to all lovers of ſcience, makes us as deſirous to render it public, as to augment that fame to which he has ſo juſt a title.

But M. Meſſier, in an admirable memoir preſented to our Royal Society in 1765, (of which an excellent tranſlation by Dr. Matty is publiſhed in the tranſactions of that year,) has done juſtice to Mr. Clairaut. And as this memoir, conſiſting of thirty pages, contains a minute and ſatisfactory detail of the manner, in which the famous Comet in queſtion was firſt diſcovered at Paris, by M. Meſſier, and afterwards obſerved by him and M. de L'iſle; we ſhall make no apology to our readers for giving them a long extract from a performance ſo fraught with entertainment and inſtruction.

1759. "In the predictions of the heavenly phe-
" nomena, which depend on the motion of the
" ſtars, two things are to be conſidered; viz. the
" time and place. As to the time, when the ve-
" locity, and direction of the ſtars in their moti-
" ons, both apparent and real are known, the
" time of their different appulſes and aſpects may
" always be foretold; and the accuracy of the
" calculations depends on the exactneſs with which
" their velocity and their ſeveral inequalities are
" aſcertained. Now it is well known, that all the
" former uncertainty as to the exact time of the
" return of the Comet foretold by Dr. Halley,
" was owing to the variations it muſt have under-
" gone from its ſeveral ſituations, and approxima-
" tions, to the planets, in its progreſs thro' the
" ſolar ſyſtem.

" Dr. Halley, who was firſt aware of the un-
" equal returns of this Comet in its former appear-
" ances, which he found to have been alternately
" of 75 and 76 years, was likewiſe the firſt who
" aſſigned their true cauſe. He aſcribed it, as I
" ſaid above, to the nearer, or more diſtant ap-

" proaches of the planets of our ſyſtem: and " having obſerved, that the Comet we are ſpeaking " of, came very near Jupiter in the ſummer of " 1681, above a year before its laſt appearance, " and remained ſeveral months in the neighbour" hood of that planet, he judged that circum" ſtance alone ſufficient to have conſiderably re" tarded its motion, and prolonged the duration " of its revolution. Hence he concluded, that " its return was not to be expected till the latter " end of 1758, or the beginning of the next year."

" Dr. Halley obſerves, in confirmation of this " opinion, that the action of Jupiter upon Saturn, " is alone ſufficient to alter the duration of Sa" turn's period one whole month; and he adds, " how much greater irregularities muſt not a Co" met be liable to, which, at its remoteſt diſtance, " gets near four times farther from the Sun than " Saturn; and whoſe velocity, in drawing near " the Sun, needs but a very ſmall increaſe to " change its elliptic into a parabolic curve."

" Dr. Halley does not determine more exactly " the time of the return of the Comet of 1682; " neither could he do it, but by determining ex" actly the effect of the neighbourhood of Jupi" ter; which muſt very ſenſibly affect the velocity " with which the Comet was moving towards the " ſun. Beſides, regard muſt be had, not only to " this approach to Jupiter in 1681, but likewiſe to " the other approaches to this, and all the other " planets, which act more or leſs upon the Comet, " as they do upon each other. In ſhort, it was " neceſſary to conſider all the different ſituations " and diſtances of all the planets, with regard to the " Comet, during the whole of its laſt revolution;

" and even during the former ones, when the re-
" turns had been found to be unequal."

" What immenſe labour! and what geometrical
" knowledge did this taſk not require? M. Clair-
" aut, of the Royal Academy of Sciences, un-
" dertook it; and his reſults differed but one
" month from the obſervation. No ſmall degree
" of exactneſs this, conſidering the immenſity of
" the object. In November 1758, he publiſhed
" his concluſion, which allowed about 618 days
" more for the period that was to end in 1759,
" than for the former; whence he inferred, that
" the Comet muſt be in its perihelion, towards
" the middle of April. He added however,
" (Journal des Scavans, Jan. 1759)'Any one may
" think with what caution I venture upon this
" publication, ſince ſo many ſmall quantities, un-
" avoidably neglected by the methods of approxi-
" mation, may very poſſibly make a month's dif-
" ference, as in the calculation of former periods.
" It accordingly proved ſo, the Comet having
" reached its perihelion on the 13th of March in
" the morning. M. Clairaut has ſince publiſhed
" the methods and calculations, by which he has
" arrived at this concluſion."

" The impatience of aſtronomers, and their deſire
" to prepare for verifying this prediction of Dr.
" Halley, had put them upon enquiring for ſeve-
" ral years, in what part of the Heavens this
" Comet was likely to appear; but being igno-
" rant of the exact time of its return, they could
" not determine the ſpot where it might be expect-
" ed to be ſeen, but by making various ſuppoſiti-
" ons as to the time of its perihelion. This Mr.
" Dirck of Klinkenberg, a famous aſtronomer in

“ Holland, had attempted ſeven or eight years
“ before; having taken the pains to calculate the
“ principal points of fourteen different tracts,
“ which the ſaid Comet was to take, upon as many
“ different ſuppoſitions relating to its paſſage thro'
“ its perihelium, almoſt from month to month,
“ from the 19th of June 1757, to the 15th of May
“ 1758; Meſſrs. Pingré, and de la Lande, proceeded
“ much in the ſame manner in the calculations
“ they publiſh'd in the memoirs of Trevoux,
“ for April 1759, firſt and ſecond parts; with this
“ difference, that the latter in their ſuppoſitions
“ had taken narrower limits, and nearer to M.
“ Clairaut's determination, who, as I ſaid before,
“ had fixed the return of this Comet to the middle
“ of April.”

“ M. de Liſle, being curious of ſeeing the Comet
“ on its firſt return, as ſoon as it could be
“ diſcovered by means of refracting, or reflecting
“ teleſcopes, before it was viſible to the naked
“ eye, thought he muſt proceed in a different
“ manner from what other aſtronomers had done,
“ to find out in what part of the heavens it muſt
“ be looked for. He conſidered, that it was not
“ neceſſary to know its place throughout its
“ whole courſe, but only at the firſt moment of
“ its appearance; becauſe, having once found it
“ out, it would be an eaſy matter afterwards to
“ trace it thro' its whole progreſs by obſervation
“ and calculation.”

“ A full deſcription of this method, is to be
“ found in an ample memoir concerning this Comet,
“ which I have laid before the Royal Academy
“ of Sciences, at Paris; and which no doubt
“ will be printed in their collection, together with

“ a northern hemiſphere, by means of which I
“ have been enabled to look for this Comet, in
“ the very place of the ſky, where it ought to
“ appear: and it was by the help of this planiſ-
“ phere, that I actually diſcovered the Comet
“ from the Marine Obſervatory at Paris, on the 21ſt
“ of January in the evening, after ſearching for
“ it two years ſucceſſively, whenever the ſky would
“ permit. The weather was extremely clear the
“ 21ſt of January the whole day and evening. I
“ ſeized this oppoatunity, and as ſoon as the ſtars
“ were viſible after ſun-ſet, I examined through a
“ Newtonian teleſcope of four feet and an half,
“ thoſe places of the ſky, where the planiſphere
“ ſhewed that the Comet was to be expected.”

“ After much pains, I perceiv’d about ſeven
“ o’clock, a light reſembling that of the Comet
“ I had obſerved the year before in Auguſt, Sep-
“ tember, October, and the beginning of Novem-
“ ber *. I immediately made a configuration of
“ this new light, with reſpect to the neighbouring
“ ſtars, in order to examine the next night, whe-
“ ther it had any motion among the fixed ſtars.
“ This light appear’d pretty large, and in the
“ middle I obſerved a nucleus, or bright ſpot,
“ which was no proof as yet that it was a Comet,
“ as there are ſome nebulous ſtars with a bright
“ ſpot in the middle.”

“ January 22, at the ſame hour as the day be-
“ fore, the ſky being equally clear, I again ſaw
“ the ſame light with a four feet and an half teleſ-
“ cope, and found it had ſenſibly changed its
“ place; but its appearances were the ſame. From

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* See Mem. de l’Acad. Roy des Scienc. Anno 1759.

" this ſecond obſervation I no longer doubted of " its being a Comet."

According to M. Meſſier, this Comet had three ſeveral appearances above the horizon, which M. de Liſle, and he calculated, as ſoon as they had made their firſt obſervations, that is as early as the month of February.

" The firſt appearance of this Comet was in the " evening, from January 21 to February 14, " when I ceaſed ſeeing it, by reaſon of its entrance into the rays of the ſun. The ſecond appearance was at the Comet's getting clear of the " rays of the ſun, in the morning, after the conjunction with that luminary, which was to take " place a few days before its paſſage through the " perihelion. I obſerved it in the morning from " the 1ſt of April to the 17th, when it entered the " rays of the ſun a ſecond time." During this ſecond appearance, the Comet was much larger, and brighter than in the middle of February; and indeed it was but 18 days paſt its perihelion. Now it is well known that Comets are much brighter after their perihelion, than at the ſame diſtance before it. " Beſides (ſays M. Meſſier) the " Comet, after paſſing the perihelion, was as near " again to the earth as on the 14th of February, " when I loſt ſight of it at night. When I ſaw " this Comet again on the 1ſt of April, I could " very plainly diſcern its tail, but could not aſcertain its length, becauſe of the morning twilight, " which was then beginning, and ſoon encreaſed " much: it filled the field of the teleſcope; and " muſt have extended far beyond: according to " what I have obſerved the tail of the Comet muſt " have ſpread to more than 25 degrees. the nu-

" cleus was conſiderable, but not well terminated,
" and it apparently exceeded the ſize of ſtars of
" the firſt magnitude; it was of a pale whitiſh co-
" lour, not unlike that of Venus. The nebuloſity
" which ſurrounded the nucleus, and went on leſ-
" ſening, ſhewed reddiſh colours; and theſe co-
" lours grew more vivid, towards the brighteſt
" part of the tail. The morning twilight, which
" increaſed apace, ſoon put an end to theſe ap-
" pearances, and afterwards made the Comet itſelf
" diſappear; however, I had been able to perceive
" it with the naked eye, when it was ſomewhat
" diſengaged from the vapours of the horizon."

" The third appearance of the Comet was on the
" 29th of April in the evening, and I went on ob-
" ſerving it till the 3d of June at night, when I ſaw
" it no more." During this laſt apparition, May 1, it appeared to the naked eye larger than ſtars of the firſt magnitude, the nucleus ſurrounded with a great coma. Its light was but faint, like that of the planets ſeen through the thick vapours of the horizon. It would have appeared brighter but for the light of the moon. In this laſt appearance of the Comet above the horizon, it was in the ſextant, and was obſerved by moſt of the aſtronomers in Europe. The whole duration of its appearance was 134 days, reckoning from the 21ſt of January to June 3.

M. de la Lande's account of the return of this Comet, (prefixed to his edition of Dr. Halley's aſtronomical tables, publiſhed in 1759, juſt after the departure of the Comet) is very full, and ſatisfactory. We ſhall therefore preſent our readers with ſuch paſſages of that work as ſeem moſt intereſting, firſt premiſing, that M. Clairaut confeſſes himſelf obliged to M. de la Lande for aſſiſting him in his great work of calculating the diſturbances incident to the Comet from its vicinity to Jupiter, &c. And M. de la Lande again, on his part, ſeems willing to participate this glory with Madame Lepaut, a lady who has long and ſucceſsfully been employed in aſtronomical calculations, to whom he acknowledged himſelf indebted for help in the part he had undertaken.

" The whole univerſe, ſays this author, has
" been witneſs to the accompliſhment of Dr.
" Halley's famous prediction, by the return of the
" Comet of 1682, which deſcended to its perihe-
" lion May 13, 1759, after a period of 27937
" days, or 76 years and 6 months."

" A German pamphlet publiſhed at Leipſick laſt January, and many printed letters from Germany aſſure us, that it was ſeen by a peaſant in the neighbourhood of Dreſden, ſo ſoon as the 25th of December 1758. An aſtronomer of the ſame country alſo obſerved it ſoon after, of which he gave information to ſeveral of his friends *. And M. Meſſier diſcovered it at M. de Liſle's, 21ſt of January (as related above.)"

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* M. le Monnier (Mercure de France, Apr. 1759.) remarks, that not only this Comet had been ſeen firſt in Saxony, but the great one of 1680 had been ſeen there likewiſe two months before it was obſerved either in France or England. Occaſioned, according to this eminent aſtronomer, by the land to the eaſtward of that electorate being ſandy and dry. And as the eaſt winds bring few clouds, they have there calm weather and a clear ſky. " It is to be wiſhed, ſays M. le Monnier, that thoſe
" who inhabit climates where the ſky is more ſerene than ours,
" may have watched this Comet as narrowly as has hitherto
" been done in France, to ſuch it will be viſible in the ſex-
" tant, that is to ſay, a little below Leo, till the end of July."

"The publick was much ſurpriſed at this Comet having no tail viſible to the naked eye, though it always had one in its former appearances. But for this many reaſons may be aſſigned. In the month of April, indeed, though the Comet was near the Sun, yet it was very far from the earth—from whence it could only be ſeen during the twilight. Now, it is well known, that not only the twilight, but even the light of the moon is ſufficient to efface the tail of a Comet. Hence we ſhould ceaſe to wonder that no tail appeared in the month of April—let us ſee now what was its poſition in 1607 and in 1682, when the ſame Comet is ſaid to have appeared with a remarkable tail. September 28th 1607, Longomontanus ſaw it with a very long and denſe tail, which was 28 days before its perihelion; now ſuppoſing the earth's diſtance from the ſun to be as 10, the Comet was then only 2 of thoſe parts diſtant from the earth, and 8 ½ from the ſun. Auguſt 29, 1682, M. Picard ſaw the Comet with a tail 30 degrees long; Hevelius allowed it only 16 degrees; but this was 16 days before its perihelion; it was then diſtant from us 3 ½ 10ths and from the ſun 6 ½."

"Hence, in both caſes, there is a more favourable combination in its diſtance, both from the ſun and the earth, than when it laſt appeared, which is ſufficient to explain the different figure it made. We ſhould then treat with all due contempt every ſuſpicion of this Comet not being the ſame as that of 1682: its inclination, perihelion, nodes, diſtance from the ſun, motion *, and even its late

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* All theſe may be ſeen and compared by any one who will take the trouble to inform himſelf of the meaning of theſe terms, and to caſt his eye over the following table, conſtructed by the the Abbé de la Caille. Leçons d'Aſtronomie 1761.

TABLE

TABLE

OF THE

Elements of the ſeveral Revolutions of HALLEY's Comet.

Year of Appearance.	Place of the Aſcending Node.				Inclination of the Orbit.			Place of Perihelion.				Log. of the Perihelion Diſtance.	Paſſage thro' the Perihelion, mean time at Paris.				Motion.	Orbit by whom Calculated
	S.	D.	M.	S.	D.	M.	S.	S.	D.	M.	S.			D.	H.	M.		
1456	1	18	30	0	17	56	0	10	1	0	0	9.767540	June	8	22	10	Retrograde	Pingré.
1531	1	19	25	0	17	56	0	10	1	39	0	9.753583	Auguſt	24	21	27	Retr.	Halley.
1607	1	20	21	0	17	2	0	10	2	16	0	9.768490	October	26	3	59	Retr.	Halley.
1682	1	20	48	0	17	42	0	10	1	36	0	9.765296	Septem.	14	21	31	Retr.	Halley.
1759	1	23	49	0	17	39	0	10	3	16	0	9.766039	March	12	13	41	Retr.	La Caille.

arrival occaſioned by the attractions of Jupiter and Saturn, which ſo well agree with calculation; all theſe circumſtances amount to ſo full and ſtriking a demonſtration, that I am aſhamed to ſtop a moment at ſuch difficulties. However, as the academy always publiſhes the reſult of its labours; and as doubts, however groundleſs, always occaſion a ſuſpenſion in the progreſs of the human mind, I I thought I ſhould be excuſed by men of ſcience if I tried to remove objections which, perhaps, with ſome may gain credit, however ill founded."

The moſt important objection, as to the return of this Comet, ariſes from the inequality of its periods, which were as follows: that from Auguſt 25, 1531, to the 26th of October 1607, was performed in 76 years, and two months; that from October 26, 1607, to September 14, 1682, was rather leſs than 75 years; and its laſt period from the 14th of September 1682, to the 13th of March 1759, which was the longeſt of all, was 76 years and ſix months; or 27,937 days, amounting to 583 days more than in the preceding period.

Dr. Halley was aware of theſe differences, and at firſt confeſſed himſelf to be a little ſtagger'd by them, nor would he have had the courage to pronounce its return ſo poſitively, if hiſtory had not informed him, that Comets had appeared in 1456, 1380 and 1305, which put their identity out of all doubt.

Theſe appearances happening alternately in ſeventy-five and ſeventy-ſix years, and as the preceding period was only of ſeventy-five years, it was natural to ſuppoſe that the next would amount to ſeventy-ſix. But as the difficulties ariſing from theſe inequalities in the periods have been foreſeen and obviated by Dr. Halley, we cannot do better than to inſert his own words.

" Perhaps ſome may object to the diverſity of
" their inclinations and periods, which is greater
" than what is obſerved in the revolutions of
" the ſame planet; ſeeing one period exceeded
" the other by more than the ſpace of one year,
" and the inclination of the Comet of the year
" 1682, exceeded that of the year 1607, by
" twenty-two entire minutes. But let it be con-
" ſidered what I mentioned at the end of the tables
" of Saturn, where it was proved that one period
" of that planet is ſometimes longer than another
" by thirteen days; and that is evidently occaſioned
" by the force of gravity tending towards the centre
" of Jupiter, which force indeed in equal diſtances
" is only the thouſandth part of that force tending
" to the Sun itſelf, by which the planets are re-
" tained in their orbits. But by a more accurate
" computation, the force of Jupiter towards Sa-
" turn, for example, in the great conjunction as
" they call it, January 26, in the year 1683, was
" found to be to the force of the Sun upon the ſame
" Saturn, as 1 to 186; the ſum of the forces there-
" fore is to the force of the Sun, as 187 to 186.
" But at the ſame diſtance from the center, the
" periodic times of bodies revolving in a circle are
" in the ſubduplicate ratio of the forces with which
" they are urged: wherefore the gravity being
" increaſed by 186th part of itſelf, the periodic time
" will be ſhortened by about the 374th part, that
" is by a whole month in Saturn. How much
" more is a Comet liable to theſe errors, which
" makes its excurſion near four times higher than

" Saturn; and whoſe velocity being increaſed by
" leſs than the 120th part of itſelf, would change
" its elliptic orbit into a parabolic trajectory."

" But it happened in the ſummer of 1681, that
" the Comet ſeen in the following year, in its de-
" ſcent towards the Sun, was in conjunction with
" Jupiter in ſuch a manner, and for ſeveral months
" ſo near him, that during all that time it muſt
" have been urged likewiſe towards the centre of
" Jupiter with near the 50th part of that force by
" which it tended towards the Sun: whence, ac-
" cording to the theory of gravity, the arc of the
" elliptic orbit, which it would have deſcribed had
" Jupiter been abſent, muſt be bent inwards to-
" wards Jupiter in an hyperbolic form winding, and
" have aſſumed a kind of curve very compounded
" and as hitherto not to be managed by the
" geometers; in which the velocity and direction
" of the moving body, in proportion to the cauſe,
" would be very different from what it otherwiſe
" had been in the ellipſes."

" Hence a reaſon may be aſſigned for the change
" of its inclination: for as the Comet in this part of
" its path had Jupiter on the north almoſt in a per-
" pendicular direction to its path, that portion of its
" orbit muſt be bent towards that quarter; and
" therefore its tangent being inclined to a greater
" angle towards the plane of the ecliptic, the angle
" of the inclination of the plane itſelf muſt be ne-
" ceſſarily increaſed. Beſides the Comet continu-
" ing long in the neighbourhood of Jupiter, after
" it had come towards him from parts much more
" remote from the Sun with a ſlower motion, and
" now being urged with the joint central forces of
" both, muſt have acquired more accelerated velo-

" city, than it could loſe in its receſs from Jupiter, " by forces acting a contrary way, its motion being " more ſwift, and the time being leſs." (*Tabulæ Aſtronomicæ.*)

When the Comet of 1682 deſcended towards the Sun and became viſible, Europe had ſcarce recovered from the terrible panick into which it had been thrown but eighteen months before by the great Comet. However, this was comparatively too inconſiderable to be much regarded, for it was little imagined then, that the leaſt of the two would become the moſt intereſting, and that it would be for ever celebrated by poſterity for having taught mankind how to know all the reſt. But however inferior to the other this Comet may have appeared in vulgar eyes, aſtronomers obſerved it with the greateſt attention. Hevelius at Dantzick, Kirch at Leipſic, Flamſtead and Halley in England, Zimmerman at Nurenburg, Baert at Toulon, Montanori at Padua, and Picard, Caſſini and la Hire at Paris. This liſt of names will ſuffice to ſhew that there can be no ſcarcity of good obſervations upon this Comet during that appearance.

In 1607 it was obſerved by the famous Kepler, who publiſhed his obſervations together with his general theory (*de Cometis Libelli* 3, *autore Joanne Keplero, auguſtæ vindelicorum* 1619.) The 16th of September old ſtile, the ſky being very clear, Kepler firſt ſaw this Comet upon the bridge at Prague, and though it had no tail when he firſt diſcovered it, yet afterwards it had one of a conſiderable length and ſplendor. It was likewiſe obſerved by Longomontanus, September 18, (*Aſtron. Danicæ appendix Amſt.* 1640.) he ſays it appeared as large as Jupiter, though with a very obſcure and pale light; that the tail was pretty long and more denſe than the tails of Comets uſually are, but as pale in colour as the Comet itſelf.

In the preceding revolution of 1531, we find our Comet obſerved by the aſtronomer Appian at Ingoldſtadt, the ſame who firſt remarked that the tails of Comets were always in an oppoſite direction to the Sun: which to him was an evident proof that the Sun was the cauſe of ſuch eruptions.

In 1456, there was a very remarakble exhibition of the ſame Comet. *Cometa in auditæ magnitudinis toto menſe Junii cum prælonga Cauda, ita ut duo fere ſigna cæli comprehenderit.* (*Theatrum Comet :*)

It is difficult to comprehend how the Comet whoſe tail was ſo inconſiderable in its laſt appearance, ſhould in this have one of ſixty degrees: but M. de la Lande in his Theory of Comets, p. 127. accounts for this difference in the following manner. "I find, ſays this active aſtronomer, that "if the Comet reached its perihelion in the beginning of June, it ought to have appeared at night "towards the middle of the month with ſixty degrees of elongation and a very northern latitude, "its diſtance from the Earth being leſs than the "ſemidiameter of the Sun: ſo that in this poſition, "which of all others is the moſt favourable, it "muſt have appeared in all the ſplendor allowed "to it by the old chronicles. Perhaps by *duo* "*ſigna*, they only mean the extent of two conſtellations, which is often much leſs than two ſigns "of the ecliptic."

In 1379 and 1380 we find two Comets mentioned by Alſtedius and Lubienietzki, but without any particulars as to the time or form of their appearance.

In 1305, our Comet again appears, according to the hiſtorians of that time, in all its terrors. *Cometa horrendæ magnitudinis viſus eſt circa ferias paſchatis, quem ſecuta eſt peſtilentia maxima,* it is very likely that the horror occaſioned by the plague had augmented the terrible impreſſion left by the Comet; however, upon calculation, it does appear that the Comet muſt this year have paſſed very near the Earth.

The hiſtory of this Comet might be traced much higher by conſulting Eckſtormius, Riccioli, Alſtedius, and Lubienietzki. Among the four hundred and fifteen Comets mentioned by this laſt writer, we find one for the year 1230, which appears to be the very Comet in queſtion; another in 1005, three periods before; it is found in 930, and higher up in the year 550, marked by the taking of Rome by Totila. All the hiſtorians of the empire ſpeak of a great Comet in the year 399, which may have been the ſame. *Cometa fuit prodigioſæ magnitudinis, horribilis aſpectu, comam ad terram uſque demittere viſus.*

In 323, that is to ſay, ſeventy-ſix years before, a Comet alſo appeared in Virgo; and in ſhort it would be eaſy to mount, without quitting the ſame periods, as high as 130 years before Chriſt, when, according to Juſtin, one appeared at the birth of Mithridates. But, in theſe early periods, there would be great danger of meeting with ſome of thoſe fabulous Comets with which it was thought neceſſary perhaps to embelliſh every famous reign: and it muſt be confeſſed too, that equal intervals between the different apparitions of Comets, are not alone ſufficient to prove their identity: ſuch equalities may indeed contribute towards the ſupport of a demonſtration founded on an agreement in their motions, and a perfect correſpondence in the other circumſtances of their appearance, but greater ſtreſs muſt not be laid upon them: for theſe compilations were not formed with the ſame care and exactneſs, which would have been beſtowed upon them, if, when they were made, it had been ſuſpected what advantages were to be derived from them. Lubienietzki ſeems to have had no other view than to compare the events ſubſequent to the appearance of Comets, in order to prove that they have preſaged *nothing*: juſt as his predeceſſors, among whom was the good father Riccioli, had compiled them in order to prove them to be *inauſpicious augurs*.

Riccioli, in his Almageſt. publiſhed in 1651, enumerates 154 Comets to be found upon record in hiſtory, the laſt of which appeared in 1618. But in the great work of Lubienietzki*, (a Poliſh gentleman deſcended from the Sobieſki family, but who being tainted by ſocinianiſm was forced to quit his country,) where not a ſingle hiſtorical circumſtance relative to Comets is omitted, the number in 1665 amounted to 415. "Since that time, ſays M. de "la Lande, in 1764 (Aſtronomie, 2 vols. 4to.) "they are increaſed to 450. But of all theſe ap-"pearances, no Comet had its path aſtronomically "deſcribed till 1264†, and the number of thoſe "which have been obſerved, with ſufficient accu-

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* Theatrum Cometicum, Amſt. 1668.

† Tractatus Fratris Egidii de Cometis.

“ racy to determine their orbits, is reduced to fifty
“ one, excluſive of the Comet of 1531, 1607,
“ 1682 and 1759 which is allowed to be only different
“ returns of one and the ſame Comet.”

It ſhould be remembered that though every meteor and ſtrange appearance in the heavens was by the ancients called a Comet, and that many of thoſe which were intitled to that appellation, were the ſame Comets ſeen at different revolutions; yet it may eaſily be ſuppoſed, that in every age, and eſpecially in the early ones, many Comets have appeared concerning which hiſtorians have been ſilent, as well as many others, which on account of their diſtance, or of cloudy ſkies, have not been viſible to the inhabitants of the globe.

We muſt not wonder then, if among the 415 Comets mentioned by Lubienietzki, there are near 400 from which nothing poſitive can be concluded. But whatever uncertainty there may be in theſe remote periods, we have four returns of one Comet perfectly well aſcertained, which joined to that of 1759, put the theory of this Comet out of the reach of cavil, and conſtitute the greateſt triumph of aſtronomy and the higheſt glory of the human mind.

Dr. Bevis obſerved this Comet in London, May 1 and 2, and exultingly ſays (Phil. Tranſ. vol. 51.)
“ I think I may now venture to pronounce this to
“ be the ſame as the Comet of 1682; and am
“ about making out its future track. If I preſume
“ rightly, it will in a ſhort time become in a manner
“ ſtationary, but diminiſh very faſt both in ſize
“ and light, the Earth and it receding from each
“ other almoſt in a right line. It is at this
“ time

"time about four times nearer the Earth than the
"Sun is."

Mr. Munckley likewiſe obſerved it at Hampſtead, April 30, May 1, 2, 5, and 6. "It is a luminous
"appearance, ſays he, very evident to the naked
"eye (notwithſtanding the light of the Moon,
"within two or three days of her quadrature) yet
"rather dim than ſplendid, large, but very ill defined,
"&c."

We cannot quit this article without mentioning, that though the period of this Comet is the ſhorteſt of any yet diſcovered, (Dr. Halley calls it the Mercury of Comets) its aphelion, or greateſt diſtance from the Sun, is thirty-five times greater than that of the Earth, and four times greater than that of Saturn, the moſt remote of any of the planets.

Indeed this Comet, ſo big with conſequences, ſeems, it muſt be allowed, very diminutive as to ſize, compared with many others: however, no one point in aſtronomy ever engaged the attention of ſo many great aſtronomers as the return of this Comet. Newton, Halley, Maupertuis, Clairaut, de Liſle, le Monnier, la Caille, Meſſier, la Lande, Pingré, &c. have been indefatigable in obſerving and calculating its courſe. There was a controverſy among the French aſtronomers, concerning the methods of finding it, and the exact time of its perihelion; but they and all the aſtronomers in Europe were unanimous in pronouncing it to be the ſame Comet which appeared in 1682; and here we cannot help repeating, for the honour of aſtronomy and of the Engliſh nation, that this Comet was firſt calculated, and its return predicted by the great Dr. Halley, in confirmation of the theory of the illuſtrious Sir Iſaac Newton.

1760. The Comet of this year was diſcovered, in the conſtellation Orion, at Cambridge, by Dr. Maſon, and at Paris by M. Meſſier, on the ſame night, and at the ſame hour: namely, January 8, about nine o'clock in the evening. January 9, the late Mr. Short, Mr. Munckley of Lincoln's-Inn, and Mr. Day at Lowick, Northamptonſhire, ſeverally obſerved it. They all ſpeak of the extream rapidity of its motion, and of the body being ill defined; but of the tail, thoſe who ſaw it in England, ſay nothing, except Mr. Short, who, after remarking that its motion was to the weſtward with a conſiderable velocity, ſeemingly about two degrees in a day, which was nearly at the rate the great Comet moved, when it was firſt ſeen in the end of the year 1743, adds, "This Comet is very viſible to the naked "eye, though I could perceive nothing of a tail, "and therefore I conclude it is going down to the "Sun." But the account of this Comet in the *Mercure de France*, of January 1760, ſays, the tail has an eaſtern direction, and is about four degrees long, but ſcarcely viſible to the naked eye. The late Dr. Stukely ſeems to have thought this Comet was the ſame as that of 1664. But Mr. Barker (Phil. Tran. vol. 52.) rather diſcourages that opinion. "The Comet of 1664, ſays he, might have "appeared nearly in the ſame place this was "ſeen, with a ſwift motion of a pretty many "degrees in a day, as a retrograde Comet in op- "poſition to the Sun generally has; but, I think, "would not have been near enough to have moved "a degree in an hour, as this did; and I think it "would have been alſo a larger and continued "longer than this; for in 1664, it was ſeen four

“ months, and when far diſtant from the earth;
“ and in the poſition it muſt have been in laſt
“ January, would hardly have gone farther back
“ than the beginning of Gemini, in ſmall north
“ latitude, and is, I believe, one of the largeſt
“ Comets.”

But M. Meſſier, who firſt diſcovered in France the three laſt mentioned Comets, ſeems to have found this year a fourth Comet, concerning which he communicated his obſervations to the Royal Academy of Sciences. This Comet, wholly different from that of which we have been ſpeaking above, was firſt ſeen by M. Meſſier, January 26, at which time it could be perceived only through a foot reflecter, though ſoon after, with great difficulty, by the naked eye. Its nucleus appeared pretty clear, and well defined, through a 4 ½ foot Newtonian teleſcope. The day of its diſcovery it was ſituated between the conſtellations *Crater* and *Hydra.* February 4, it it was viſible in *Leo:* and on the eighth appeared to the naked eye equal to a ſtar of the third or fourth magnitude, and was very brilliant, having a tail (viſible indeed only through a teleſcope) of many degrees in length, with a weſtern direction.

1762. The Comet which appeared this year, is ſuppoſed by Mr. Struick and M. Pingré, who both obſerved it, and compared their obſervations with thoſe of other aſtronomers, to be the ſame with that which appeared 169 years before, viz. in 1593. Its courſe was direct, and it arrived at its perihelion, May 28. In conſtructing the elements of this Comet, a remarkable ſingularity occurred to M. Pingré: he found that it had paſſed eleven times nearer the Sun than the Earth does when it is in its perihelion; and likewiſe, that though it was ſeen a very few days after its perihelion, and might be expected to have equalled the celebrated Comet of 1680 in ſplendor, yet it did not exceed in brightneſs a ſtar of the third magnitude, its tail at the ſame time not extending above four degrees. M. Pingré therefore ſuppoſes it to have been very ſmall, and that its atmoſphere was not qualified to abſorb or attract, according to M. Mairan's ingenious ſyſtem, a ſufficient quantity of thoſe luminous particles, which ſays M. Mairan, compoſe the ſolar atmoſphere*.

1764. Another Comet is this year diſcovered, in the conſtellation of the Dragon, by M. Meſſier, at the Marine Obſervatory at Paris; of which he has ſent a table of the places to our Royal Society, from January 3, to February 11, together with the elements of the theory of this Comet, deduced from the firſt obſervations of M. Meſſier by M. Pingré. This Comet paſſed by the perihelion, February 12, with a retrograde motion.

1766. Two Comets are this year diſcovered by the vigilant and perſpicacious M. Meſſier. Theſe ſtars by being ſo numerous, will ſoon ceaſe to be regarded with the ſame wonder as formerly; however, it muſt be owned, that the frequency of theſe diſcoveries is in a great meaſure owing to the uſe and improvement of teleſcopes; without which, we ſhould know no more of many that have lately been ſeen, than our ſhort-ſighted forefathers did of the ſatellites of Jupiter and Saturn. As to M.

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* This article is extracted from the Hiſt. de l'Acad. des Sciences, for the year 1763, in which volume M. Bailly gives ſeveral obſervations on the ſame Comet.

Meſſier, he is ſo conſtantly on the look out, and ſo dextrous in diſcovering them, that it would incline one to believe with Caſſini, that there was really a zodiac of Comets, and that M. Meſſier alone knew its place and limits in the heavens.

The firſt Comet of this year was diſcovered at the Marine Obſervatory at Paris, March the 8th, in the conſtellation of *Piſces*, and obſerved till the 15th of the ſame month; its motion was retrograde, and it ſeem'd in ſize, equal to a ſtar of the fourth magnitude.

The ſecond Comet was at firſt diſcovered with the naked eye, April the 8th, near the *Pleiades*, and promiſed to become conſiderable. The next day the tail was ſix or ſeven degrees long, and the nucleus equally luminous with ſtars of the third magnitude. It was however viſible only till the 12th. M. Meſſier ſent tables of the places of theſe Comets to the Royal Society this year, together with a calculation of the elements of their orbits by M. Pingré.

The ſecond of theſe two Comets was diſcovered at Louiſburg, in the iſland of Cape Breton, April the 7th, which was one day ſooner than even M. Meſſier had ſeen it at Paris. In this obſervation, made by Captain Holland, the tail of the Comet appeared perpendicular to the horizon, with its head towards the ſun.

Mr. Brice obſerved the ſame Comet at Kirknewton, April the 10th. It was then deſcending towards the ſun, at the rate of about ſix degrees in the ſpace of twenty-four hours. To this gentleman's account, in the Philoſophical Tranſactions, is prefixed a plate of the appearance of the Comet.

1769. The firſt intelligence we had of this Comet in England, was from the indefatigable M. Meſſier, aſtronomer, keeper of the journals, plans and maps belonging to the marine of France, who diſcovered it the 8th of Auguſt, about 11 in the evening, in the conſtellation Aries, between the 24th 25th and 31ſt ſtars of that conſtellation in the Britiſh catalogue. On the 14th and 15th of the ſame month it appeared very diſtinctly, having a tail about ſix degrees in length. This information was inſerted in the St. James's Chronicle, Auguſt 25, which ſet us all to work in order to find it here. Not many days had elapſed, ere it was ſeen by all who were poſſeſs'd of teleſcopes, and in the beginning of September, it was viſible to the naked eye, about three o'clock in the morning, in the conſtellation of Taurus, with a tail fifteen degrees long. The body of this Comet became more conſiderable to our view, till the middle of September, when the tail was of an enormous breadth, and extended to upwards of 40 degrees in length.

The publick is, doubtleſs, much obliged to Mr. Dunn, for his obſervations, which appeared ſo frequently in the news-papers, though he put them in a great fright for our beautiful morning and evening ſtar, the planet Venus, which, "he thought "likely to receive a *bruſh* from the Comet's tail." However, he did not ſuffer their anxiety to continue long, but ventured two or three days after to pronounce Venus out of danger.—But may we not ſuppoſe that the whole ſolar ſyſtem, that is to ſay, our ſun—with its ſix planets, ten moons, and comets,

mets, as yet unnumbered, are ſo combined together, ſo dependent one on another, and ſo much one family, that neither Venus, the Earth, nor any one part of this ſyſtem can ſuffer alone, as ruin to one, would perhaps be ruin to all.

From nature's chain whatever link you ſtrike,
Tenth or ten thouſandth, breaks the chain alike.

It has been ſaid above, that 450 Comets are recorded in hiſtory. Now if we conſider, that moſt of theſe Comets deſcend more or leſs, into the ſphere of the orb of the earth; and that out of thoſe whoſe orbits have been calculated, there are only ſix whoſe leaſt diſtance from the ſun, exceeds that of the earth.—Yet ſtill, no accident has happened that we can trace in the hiſtory of the moſt remote ages of the world.—May we not ſuppoſe, that room enough is aſſign'd in infinite ſpace, by infinite power, for theſe orbs to move in, without falling foul of each other, as if left to the guidance of blind and blundering chance; and that we have nothing to apprehend from ſhort-ſighted predictions, or fanciful hypotheſes.

It is therefore to prevent too great diſturbances in the motions of Comets from the action of the planets and other Comets, ſays Sir Iſaac Newton, that while the planets revolve all of them nearly in the ſame plane, the Comets are diſpoſed in very different ones, and diſtributed over the whole ſyſtem.

Maclaurin, too, has an admirable reflection upon this ſubject, in his paraphraſe on Sir Iſaac Newton's Principia. Speaking of the fatal effects that ſeemed poſſible to happen from the near approach of the great Comet of 1680 to the earth, ſays, "it is not to be doubted but that, while ſo many Comets paſs among the orbits of the planets, and carry ſuch immenſe tails along with them, we ſhould have been called by very extraordinary conſequences, to attend to theſe bodies long ago, if their motions in the univerſe had not been at firſt deſigned and produced by a being of ſufficient ſkill to foreſee their diſtant conſequences."

The preſent Comet totally diſappeared about the 16th, being immerged in the rays of the ſun, paſſing with great rapidity to its perihelion, from whence we are now (October) impatiently expecting its return.

By an article from Paris we are likewiſe informed that it became inviſible there the ſame day on which it retired from us.

"The late Comet, ſo much talked of, was diſcovered at Paris the 8th of laſt Auguſt, by that indefatigable aſtronomer, M. Meſſier, whoſe aſſiduity and dexterity in obſerving the heavenly bodies, have long ſince deſerved the higheſt praiſes from the learned; and he was honoured on this preſent occaſion with a letter, wrote to him upon the ſubject, by one of the greateſt monarchs in Europe, and geniuſes of this age. The accurate obſerver followed obſerving the courſe of the Comet till the 16th of September, when it ceaſed to be viſible by its approaching to the ſun, being then near the alpha of Hydra. Its elements have been calculated by M. de la Lande, upon three equidiſtant obſervations of M. Meſſier, made on the 14th, 21ſt, and 28th of Auguſt, and are as follows:

" Inclination of the orbit, 73 deg. 15 min. Deſcending node, 11 ſign. 26 deg. 23 min. Perihelion, 6 ſign. 11 deg. 28 min. Paſſage at the perihelion the 1ſt of October, at 9 and 22 min. Diſtance of the perihelion, 0,03104; that is to ſay, 32 times nearer to the ſun than our globe ever is. From this it appears, that this Comet does not reſemble any of the 57 Comets we know of; only the two ſeen in the years 1680 and 1689, did approach neareſt to the ſun. The laſt of them ſhould have ſome likeneſs to this, were it not for the great difference between the diſtances of their reſpective perihelions, which take away any ſuſpicion of this being the ſame."

According to the perihilion diſtance given to this Comet by M. de la Lande, it might have been expected to return ſooner than has been found by experience, as the velocity it would have acquired by ſuch a near approach to the Sun, would have been accelerated, and its trajectory diminiſhed.

As this Comet, in its way to the Sun, ſet weſtward of that luminary, it will riſe from its rays on the other ſide; namely, eaſtward of the Sun.

There is a popular diviſion of Comets into three kinds; namely, *tailed*, *bearded*, and *hairy* Comets, though this diviſion rather relates to the different circumſtances and ſituations of the ſame Comet, than to the phenomena of ſeveral.

Thus, when the light is weſtward of the Sun, and ſets after it, the Comet is ſaid to be *tailed*, becauſe the train follows it in manner of a tail.

When the Comet is eaſtward of the Sun, and moves from it, the Comet is ſaid to be *bearded*, becauſe the light marches before it in manner of a beard.

And laſtly, when the Comet and the Sun are diametrically oppoſite, (the Earth between them) the train is hid behind the body of the Comet, except a little that appears round it, in form of a *border of hair*.*

The tails of Comets are always on the ſide oppoſite to the Sun. This was firſt diſcovered by Appian, and has ſince been conſtantly confirmed by obſervation. They are beſt ſeen, and appear longeſt in ſouthern climates, where the air is pure and ſky ſerene. The Comet of 1759 appeared at Paris almoſt without a tail, and in England entirely without one. At the former place, it was with great difficulty that a ſlight trace of one could be diſtinguiſhed of only one or two degrees in length; whereas at Montpelier, M. de Ratte found it to have one, April 29, of 25 degrees in its whole length, and 10 degrees of it extremely luminous; but M. de la Nux ſaw that Comet, at the iſle of Bourbon, with a tail much more conſiderable; for the ſame reaſon that the zodiacal light is always viſible there, and extends to above 100 degrees in length.

But there have been Comets, whoſe diſk was as round, as well defined, and as clear as that of Jupiter, without either tail, beard, or coma; ſuch was one of the Comets that appeared in 1665, and, according to Caſſini, that of 1682. Hence the tail of a Comet muſt not always be regarded as its neceſſary appendage, or principal characteriſtick.

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* From this laſt appearance the word Comet is derived; as Κομητης, *Cometa*, comes from Κομη, *Coma*, a head of hair.

Moſt Comets are viſibly ſurrounded with an enormous atmoſphere, often riſing ten times higher than the nucleus, or ſolid body of the Comet. Sir Iſaac Newton ſuppoſes it to be owing to the atmoſphere of a Comet, that the nucleus is uſually ſo ill defined; the moſt lucid parts of which not being above a ninth or tenth part of the whole breadth. In obſervations upon Comets, it is common to meet with accounts of bright ſpots in the middle of the nucleus, when in fact it ſhould ſeem that the bright ſpot only was the nucleus, and the reſt the atmoſphere of the Comet.

M. de la Lande ſuppoſes very ingeniouſly, that as Comets are deſtined to paſs from the moſt dreadful rarefaction and heat imaginable, to a cold denſity beyond conception, they are provided with theſe immenſe atmoſpheres, not only to protect them from ſuch deſtructive exceſſes, but likewiſe to ſupport and foment circulation, fluidity, motion, and life.

It has been remarked that Comets have different phaſes, like the Moon; and it was obſerved by Caſſini, in the year 1744, that the body of that Comet was horned, ſhewing only half its diſk.

The preſent Comet, ſeen through a good teleſcope, ſeems more to reſemble a ſmall Moon than a fixed ſtar. The nucleus, or body of it, is large, but ill defined. The phænomena of the tail ſeems ſo much to favour an ingenious conjecture in the

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Monthly Review, (Oct. 1767, p. 253.) that we cannot reſiſt quoting it.

The book under examination is Dr. Prieſtley's Hiſtory of Electricity: “ Signior Beccaria has,
“ with great ingenuity, mixed ſometimes with a
“ little ſpice of agreeable extravagance, the fre-
“ quent concomitant of genius, ranged almoſt all
“ the meteoric phenomena under the banners of
“ electricity; from the *Will-o'-th'-Wiſp* up to the
“ *Aurora Borealis*. Had we room or inclination to
“ theoriſe on this ſubject, at the ſame time that,
“ with other electricians, we allowed the electric
“ fluid to be the cauſe of this laſt phenomenon,
“ we ſhould be for extending its connections ſtill
“ further, and attempt to ſhew the poſſibility, at
“ leaſt, of its near relation to, if not its identity
“ with, that luminous matter which forms the ſolar
“ atmoſphere, and produces the phænomenon called
“ the *Zodiacal Light*; which is thrown off princi-
“ pally, and to the greateſt diſtance from the equa-
“ torial parts of the Sun, in conſequence of his
“ rotation on his axis, extending viſibly, in the
“ form of a luminous pyramid, as far as the orbit
“ of the Earth; and which, according to M. de
“ Mairan's ingenious, and, at leaſt, plauſible hy-
“ potheſis, falling into the upper regions of our
“ atmoſphere, is collected chiefly towards the polar
“ parts of the Earth, in conſequence of the diur-
“ nal revolutions, where it forms the *Aurora Bo-*
“ *realis*. It would, we think, be no very bad
“ hypotheſis which ſhould unite theſe two opi-
“ nions, by conſidering the Sun as the fountain of
“ the electric fluid, and the zodiacal light, *the*
“ *tails of Comets*, the *Aurora Borealis*, lightning,
“ and artificial electricity, as its various, and not
“ very diſſimilar modifications.” Indeed the ap-

pearances of the tail of this Comet reſembled electrical coruſcations, more than any thing of which we have an idea, but moſtly that produced *in vacuo*; as the flame ſeemed, through a teleſcope, perpetually to ſhoot out in ſtrait lines, of a pale-ſilver hue, lengthening and ſhortening at each inſtant, and forming frequently ſome of the configurations which the *Aurora Borealis* aſſumes.

There has been lately publiſhed a work by Dr. Hamilton of Dublin, under the title of Philoſophical Eſſays; in which this idea ſeems extremely well developed. The ſubject and ſubſtance of the Doctor's ſecond eſſay is ſo full to our purpoſe, that we ſhall condenſe it into an epitome, and preſent it to our readers.

Dr. Hamilton's Eſſay has for title, Obſervations and Conjectures on the Nature of the *Aurora Borealis*, and *the tails of Comets*.

The author differs from Sir Iſaac Newton, concerning the nature of the tails of Comets; and endeavours to prove that they are compoſed of a lucid, or ſelf-ſhining ſubſtance, and not a mere cloud or vapour, illuminated only by the Sun. This luminous matter he ſuppoſes to be the ſame with that which cauſes the Aurora Borealis, and the phænomena of electricity.

" The great body of luminous matter which
" appears in an *Aurora Borealis*, ſays this Author,
" being ſo very extenſive, and ſometimes ſo very
" bright, muſt be viſible to a ſpectator at a conſi-
" derable diſtance from the Earth, and ſhaded
" from the Sun's light; and ſuch a ſpectator

" would then ſee the Earth attended by a train of " light in the form of a *tail,*" &c.

" Electric matter appears to be of the ſame " kind of ſubſtance which forms the *Aurora Borealis,* and *the tails of Comets*; by its having " alſo that remarkable property of letting the " rays of light paſs through it, without having any " ſort of effect upon them." " Now the extraordinary rarity of Comets tails may be collected, " ſays Sir Iſaac Newton, from the ſtars ſhining " through them; for the ſmalleſt ſtars are obſerved to ſhine without loſs of ſplendor through " tails which are of an immenſe thickneſs." (*Principia,* p. 513, edit. 2.) Dr. Hamilton has given to Comets a quite different employment from that allotted to them by Sir Iſaac Newton, who made them water-carriers, loading them with vapours and moiſture, to ſupply the loſſes of the ſeveral parts of the ſolar ſyſtem through which they were deſtined to paſs. But the Doctor, on the contrary, ſuppoſes it their buſineſs to collect and bring back to the Sun and planets, the electric fluid which is conſtantly flying off into the higher regions of the heavens, beyond the orbit of Saturn. " We ſee " this fluid riſes from the earth into the atmoſphere, and is probably going off from thence, " when it appears in the *Aurora Borealis.* And as " this electric matter, from its vaſt ſubtilty and " velocity, ſeems capable of making great excurſions from the planetary ſyſtem, the ſeveral " Comets in their long excurſions from the Sun, " in all directions, may overtake this matter, and " attracting it to themſelves, may come back replete with it, and being again heated and excited " by the Sun, may diſcharge and diſperſe it among " the planets, and ſo keep up a circulation of this

" matter, which we have reaſon to think neceſſary
" in our ſyſtem."

This does not ſeem far from Sir Iſaac Newton's own opinion: for after ſuppoſing that the aqueous particles thrown off from Comets are taken up by the planets, as a ſupply of moiſture, adds, " I " ſuſpect, moreover, that that ſpirit which is the " leaſt, but the moſt ſubtile, and the beſt part of " our air, and is neceſſary for ſupporting the life " of all things, comes chiefly from the Comets."

Dr. Halley, ſo long ſince as the year 1716, in his deſcription of a remarkable *Aurora Borealis*, ſays, " That the great ſtreams of light ſo much " reſembled the tails of Comets, that at firſt ſight " they might well be taken for ſuch;" and afterwards adds, " This light ſeems to have a great " affinity to that which the effluvia of electric bo- " dies emit in the dark." This was the doctor's conjecture;—but both he, and Sir Iſaac Newton, had ſo much of vaticination in all they ſaid, that their conjectures are found by poſterity to be little leſs than certainties.

But this ſtriking ſimilarity between the appearances of the tail of the Comet in a teleſcope, the *Lumen Boreale*, and the electric flaſh, was ſuggeſted to the writer of this hiſtorical ſketch by the phænomena themſelves, and not by the paſſages juſt quoted, of which he had not the leaſt knowledge till after he had formed his opinion on the ſubject, but which indeed he was glad to have fortified by ſuch good authorities.

It is with diffidence he mentions another teleſcopic appearance, as it may perhaps be only an optical illuſion. It ſeemed perceptible that the nucleus of the Comet had a very rapid motion on its own axis, and that there was a conſtant emiſſion of electric ſparks, or flaſhes from it at all points, which were inſtantly impelled with great violence towards the tail.

It has not as yet been poſitively determined by aſtronomers, whether this preſent Comet is one of thoſe that have ever viſited us before, at leaſt ſince Comets have been ſo narrowly watched. But it is hoped that the worthy ſucceſſor of the great Flamſtead, Halley and Bradley, by whom this Comet will doubtleſs have been well obſerved, will clear up this point, when he ſhall have had ſufficient leiſure for computing its elements, and comparing them with thoſe of other Comets already computed. Out of above 50 Comets whoſe elements are known, the returns of no more than 5 or 6 have been foretold: which may be ſeen in the following table.

Former Appearances.	Years Period	Return expec. about	Orbits by whom calculated:
—————— 1532 : 1661	129	1789	Halley.
1531 : 1607 : 1682 : 1759	76	1834	Halley.
—————— 1264 : 1556	292	1848	Halley.
1165 : 1338 : 1512 : 1686	174	1860	Pingré.
—————— 1593 : 1762	169	1931	La Caille, Pingré.
44 Ant. C. 531 : 1106 : 1680	575	2255	Newton. Halley.

The Comets that are firſt expected, are placed firſt in the table. But it may be neceſſary to give the authorities upon which this table is conſtructed.

The Comet of 1661 obſerved by Hevelius, and that of 1532 by Appianus, (though there is a conſiderable difference in the places of their perihelions, which may eaſily be attributed to the imperfect and unſkilful manner in which it was obſerved by Appianus) may be the ſame; and if Halley's conjecture be well founded, this Comet will again appear in the year 1789 or 1790. (*Hiſt. des Mat. par. Montucla.*)

Of the ſecond Comet enough has already been ſaid, under the article 1759. Unleſs we here beſtow a few words upon the memory of M. Clairaut, who died May 3, 1765, aged but 52 years! in his elogium juſt publiſhed in the *Hiſt. de l'Acad. des Sciences*, there is this paſſage, equally appertaining to that great geometrician and to this article.—" Thanks to his labours, the opinion that " Comets are planets, as ancient as the world itſelf, " is now no longer a conjecture, but is regarded " as a thing fully demonſtrated."

For the account of that which has the third place in the table, we are indebted to Mr. Dunthorne, (Phil. Tranſ. vol. 47.) who conjectures, that if the Comet which appeared in 1264 be the ſame as that which was obſerved by Paul Fabricius and others in the year 1556, and whoſe orbit Dr. Halley has compared, its period will turn out as above.

Concerning the Comet which occupies the fourth place in the table, we are indebted to M. Struick, who in his ſequel to the deſcription of Comets, (Amſt. 1753) ſuppoſes the Comet of 1686 to be the ſame as that of 1512; " for one is upon re" cord in 1338,—in 1165,—in 990,—in 817,— " and in ſhort 870 years before, that is to ſay, " at the diſtance of 5 times 174 years; 53 years " before Chriſt."

Our authority for the fifth Comet in the table, is given in the article for the year 1762.

And about the ſixth or great Comet of 1680, which ſo alarmed the inhabitants of our globe in the laſt century, though the preſent is but little intereſted, ſo diſtant is the period. "Yet, if it re-
" turn in 2255," ſays Maclaurin, "it will give a
" new luſtre and evidence to Sir Iſaac Newton's
" philoſophy, in that remote age. And ſhould
" the inconſtancy of human affairs, and the per-
" petual revolutions to which they are ſubject, oc-
" caſion any neglect of our philoſophy in the in-
" tervening ages; this Comet will revive it, and
" fill every mouth again with this great man's
" name. For it is one of the good effects which
" theſe great periods, and diſtant depending ob-
" ſervations promiſe, that they muſt contribute
" to preſerve the reliſh for learning from the re-
" volutions to which it has been formerly ſubject.
" By them, diſtant ages are connected together,
" and perpetual matter is provided from time to
" time, for reviving the curioſity of mankind."

And though the returns of no more than ſix Comets have, as yet, been calculated and foretold by aſtronomers; yet, from the elements laid down, every age will recognize ſome of thoſe which have viſited us before; till at length, the whole number of Comets in the ſolar ſyſtem will be as well known to the inhabitants of the earth, as the five planets and their ſatellites.

One of them is already added to the number of revolving planets, which it is hoped will leſſen the popular dread at the appearance of the reſt. At this time of day it ſeems ſcarcely neceſſary to ſay, that the experience of many thouſand years aſſures us that the ſolar ſyſtem is ſo wiſely framed and regulated, as not to be ſubject to accidents from the approach of Comets. But as two ſuch able aſtronomers and mathematicians, as Whiſton and Gregory, ſeem to encourage the belief that general ruin, or at leaſt dreadful calamities, may be the conſequence of a near approximation to the tail of a Comet, and as their opinions have no other foundation than conjecture and ſpeculation, we may venture, without arrogance, to conjecture and ſpeculate in our turn.

And firſt, let us ſpeak to Mr. Whiſton, who having (as has been mentioned in M. Maupertuis's Letter) with great learning and labour traced the great Comet of 1680 by different periods, of 575 years, up to the univerſal deluge, endeavours to account for that terrible cataſtrophe, by the water that was brought into our atmoſphere by the tail of that Comet. We will, for a moment, grant it poſſible for Comets to quit the regular and ſtated courſe originally aſſigned them, and likewiſe, for the ſake of Mr. Whiſton's hypotheſis, ſuppoſe the tails of Comets to be compoſed of aqueous vapours (an opinion which, with, Dr. Hamilton's aſſiſtance, we have endeavoured to confute) yet ſtill a powerful objection to the deluge having been occaſioned by the tail of the Comet remains; namely, that vapours at ſuch a great diſtance from the earth would be ſo rarified, that notwithſtanding the Comet of 1744 had a tail 40 degrees long, the preſent Comet one of 42, and that of 1680 one of 70 degrees in length—if all the waters of this enormous tail were compreſſed into the denſity of thoſe vapours in our atmoſphere which coaleſcing, compoſe rain; they would be inſufficient for the purpoſe of drowning the earth: ſince a ſingle drop of water, rarified into vapour in our groſs atmoſphere, occupies 14,000 times the ſpace it did, when condenſed into water; and vapours ſufficiently rarified to ſwim in Æther, though they formed a volume equal to the orbit of the Earth, would not furniſh water enough to overwhelm it, which Sir Iſaac Newton has demonſtrated by proving that a cubick foot of water, at the diſtance of a ſemidiameter of the earth, would be ſo rarified as to occupy a ſpace equal to the orbit of Saturn.

It has been ſaid above by M. Maupertuis, that Dr. Gregory has eſtabliſhed the Comets again in all their terrors. In ſuppoſing ſuch dreadful conſequences from a Comet's tail being in contact with our earth, &c.—if the learned Doctor were ſtill living, one would be inclined to aſk him, why the poor old ladies are ſtill to be frightened with Comets? Do they either portend or occaſion any thing worſe than always ſubſiſts? When was the world without its plague, peſtilence and famine; battle, murder and ſudden death? Though Comets are doubtleſs placed in the heavens for ſome wiſe purpoſe, wholly inſcrutable to us, yet, for any thing we have hitherto diſcovered, they have no more influence or effect upon our globe, or its inhabitants, than a *will-o'-th'-wiſp* or *ignis fatuus*;—and yet every thing that is miſchievous or diſagreeable is placed to the account of the poor Comet.—If it rains, "it is the Comet;"—if the weather be hot, "it is the Comet;"—if it be cold, it is the ſame.—Pray let us be a little equitable, and allow that ſuch things as abundant rain, intemperate heat, and intenſe cold, have happened in this climate before now, without the agency of a Comet; unleſs by ſome Comet that has appeared in diſguiſe, like Mr. Bayes's army.

“ The war in the weſtern parts of Europe, which
“ continued from the year 1688 to 1697, has been
“ the moſt obſtinate and deſtructive of any re-
“ corded in hiſtory; and yet no Comet has ap-
“ peared, either immediately before or after; but
“ on the contrary, one has been ſeen in September,
“ 1698, when Europe was already freed from this
“ war, and was on the point of eſtabliſhing a laſt-
“ ing peace between the Chriſtians and Turks.—
“ A Comet therefore has appeared between two
“ treaties of peace, which have put an end to the
“ ravages of war, in all parts of Europe, and
“ greatly changed the general ſituation of affairs
“ for the better: A Comet which reſtores thoſe
“ happy times, in which the temple of Janus is
“ ſhut.” (*Penſées div. ſur la comete de* 1680).

But ſuperſtitious people love to be frightened, and will be as angry with any one who endeavours to reaſon them out of their fears, as the inhabitants of *Neuf Chatel* were lately with one of their paſtors, who, though in other reſpects an orthodox and devout Chriſtian, yet could not reconcile to his belief the *eternity of hell torments.*—He would allow them to laſt a hundred thouſand years, with all his heart,—but that would not ſatisfy his flock,—they proſecuted, perſecuted, and pelted him. When the king of Pruſſia, their ſovereign, hearing of it, and moreover that the miniſter was a worthy, well-meaning man, ordered them to deſiſt, and ſuffer him to reſume his function. But this enraged them ten times more,—they ſurrounded the good man's houſe, and would certainly have ſent him to the other world, to enquire into the true ſtate of de-

departed ſouls, had he not with great difficulty made his eſcape;—and, at length, their ſovereign, finding how fond they were of everlaſting damnation, out of his great goodneſs, condeſcended to let them be damned to all eternity.—“ And I alſo, “ (ſays the author from whence this account is “ taken) conſent with all my heart, and much “ good may it do them.”—*Lettre de M. Baudinet.*

It is amazing that ſuch as are always ready to denounce divine vengeance, and to preſage every ſpecies of calamity to the frighted inhabitants of the globe, upon the appearance of a Comet;—that they, whoſe belief of the interpoſition of a *particular Providence* upon every trivial occaſion, is ſo firm, never ſhould think of extending their faith to the belief of a *general Providence*, which has ſecured the globe from contingent evils.

But there yet remain many who will have it that “ a Comet never appears without blood,”—and are ſure to be right in their conjectures. For if Europe ſhould enjoy a profound peace, they have only to look at Aſia; and if all be quiet there, they have ſtill the other two quarters of the globe to fly to, which will, doubtleſs, furniſh them not only with carnage enough, but alſo with every other kind of evil, both phyſical and moral, their hearts can wiſh, to confirm them in their opinion.

But thoſe who are unwilling to ſee God, but in vengeance and deſtruction, ſhould try to diſcover him in his goodneſs and protection from general calamity, by that wiſe order of his Providence, ſo viſible in the wonderful and ſtupendous arrangement of the univerſe.

THE END.